Journal of Dental Sciences (2011) 6, 170—175

available at www.sciencedirect.com

ScienceDirect

journal homepage: www.e-jds.com

Original Article

Oral-health status of inpatients with schizophrenia in Taiwan

Kuan-Yu Chu [1,2†], Nan-Ping Yang [1,3], Pesus Chou [1], Hsien-Jane Chiu [1,4†], Lin-Yang Chi [1,5,6*]

[1] *Community Medicine Research Center and Institute of Public Health, National Yang-Ming University, Taipei, Taiwan*
[2] *Department of Dentistry, New Taipei City Hospital, New Taipei City, Taiwan*
[3] *Department of Geriatrics, Tao-Yuan General Hospital, Department of Health, Taoyuan, Taiwan*
[4] *Department of Psychiatry, Jianan Mental Hospital, Department of Health, Tainan, Taiwan*
[5] *Department of Dentistry, National Yang-Ming University, Taipei, Taiwan*
[6] *Department of Dentistry, Taipei City Hospital, Taipei, Taiwan*

Received 13 May 2011; accepted 25 June 2011
Available online 22 July 2011

KEYWORDS
community periodontal index;
DMFT;
filling rate of the DMFT index;
number of teeth;
schizophrenia

Abstract *Background/purpose:* A cross-sectional survey of oral health was conducted in a specific psychiatric hospital in Yu-Li, Hualien County, eastern Taiwan in 2006. In this study, we provide descriptive epidemiological information on the oral-health status of inpatients with schizophrenia and evaluate associations between some potential factors and oral-health indices in this population.
Materials and methods: In total, 1103 inpatients with schizophrenia participated in this survey. A clinical survey method, consisting of an oral examination with dental instruments and a light source, was used. The indices of this survey were consistent with those recommended by the World Health Organization. Multiple regression models were used to measure the independent effect of each subject's characteristics on specific oral-health indices.
Results: Among subjects with schizophrenia, the caries experience was 98.5%; the average number of decayed, missing, and filled permanent teeth (DMFT) was 13.9; the mean filling rate of the DMFT index was 14.3%; average number of teeth was 17.7; 5% were edentulous; and 39.4% had periodontal pockets of >4 mm (community periodontal index ≥3). The multiple regression results indicated that the DMFT, number of teeth, and community periodontal index ≥3 were only associated with age after adjusting for other potential independent variables. At the same time, aging men with lower educational levels and a longer

* Corresponding author. Department of Dentistry, National Yang-Ming University, 155 Linong Street, Section 2, Beitou District, Taipei 112, Taiwan. Tel.: +886 2 28267246; fax: +886 2 28264053.
E-mail address: chily@ym.edu.tw (L.-Y. Chi).
† Kuan-Yu Chu and Hsien-Jane Chiu contributed equally to this work.

doi:10.1016/j.jds.2011.05.008

stay in institutions were likely to have lower filling rate of the DMFT index scores in this population.
Conclusions: The findings of this study indicate the unmet dental-treatment needs of inpatients with schizophrenia and support the conclusion that they lack proper dental care. We therefore suggest that long-term care institutions that care for inpatients with schizophrenia should exert greater efforts in providing dental care for this special population.

Introduction

Schizophrenia is a psychiatric disorder characterized by thought disturbances and aberrant behavior. It may diminish a person's self-care abilities, including oral-hygiene maintenance.[1,2] One study estimated that the cumulative prevalence and annual incidence density of schizophrenia in Taiwan are about 0.64 of 100 and 0.45 of 1000, respectively.[3] Studies also showed that people with schizophrenia are generally perceived as receiving inadequate dental care and having poorer oral health.[4–6] According to an earlier study, there are congenital and acquired factors contributing to the poor oral health among inpatients with schizophrenia. According to congenital factors, gender is associated with the onset and manifestation of the disorder, and patients sometimes have limited access to dental treatment because of financial constraints. As to acquired factors, some antipsychotic agents that patients consume have adverse side effects on oral health. There is also an insufficient number of dentists who can provide oral-health care in long-term care institutions.[7,8]

Female patients with psychiatric diseases were reported to have significantly higher values for the decay, missing, and filled permanent teeth (DMFT) index than males.[9] Most patients with schizophrenia are on medication for long periods and these medications frequently cause xerostomia, leading to an increased risk of dental caries, gingivitis, and periodontitis. Furthermore, studies indicated that age and length of stay (LOS) in institutions are both significantly associated with poor oral health among inpatients with psychiatric diseases.[10–12]

Poor oral health was reported among psychiatric inpatients.[13–15] However, few studies have been conducted on the oral-health status of inpatients with schizophrenia in Taiwan. Therefore, in this study, we provide descriptive epidemiological information on the oral-health status of inpatients with schizophrenia and evaluate the association between some potential factors and oral indices in this country.

Materials and methods

Subjects

This study involved a sample hospital that offers long-term medical care for chronic psychotics. Located in Hualien County, eastern Taiwan, this hospital admits psychiatric patients from all over Taiwan. As of July 2006, the hospital had admitted about 2330 patients. We selected all patients with schizophrenia (ICD-9 code: 295) as the primary psychiatric diagnosis to undergo a standardized oral-health examination conducted at the hospital's department of dentistry. In total, 1468 patients with schizophrenia were involved in the study; whereas, 1103 patients (for a response rate of 75.1%) participated and completed the oral-health examination. Ethical clearance was obtained from the Ethical Committee of Yu-Li Hospital, Department of Health, Taiwan.

Oral-health examinations

Before the survey, we conducted pre-examinations and completed oral-health examination forms. The examination form consisted of two parts: general information and the oral-health status. General information of participating patients was obtained from chart reviews. Furthermore, an oral-health examination was performed under standard conditions in a dental chair with adequate light and proper dental instruments. The index for oral health we used was consistent with those recommended by the World Health Organization (WHO).[16]

Oral-health index

The DMFT index was initially determined to describe the condition of dental caries among subjects. Each tooth was scored as to whether it was sound or diseased and whether there was evidence of treated or untreated clinical caries. If a tooth was diseased it was recorded under one of the following three categories: (1) frank cavitation, untreated (decayed teeth), (2) lost for any reason or hopeless with an indication for extraction [missing teeth (MT)], or (3) evidence of restorative treatment resulting from caries [filled teeth (FT)]. Thereafter, subjects' filling rate of the DMFT index (FI) and the number of teeth (NT) were individually assessed. The FI was calculated as the rate between the number of FT and DMFT index, excluding those with no dental caries experience (CEs). Furthermore, the past and present dental CEs, (DMFT $>$ 0) for each tooth with dichotomous measures were recorded during the oral-health examination of each subject. Edentulism (Ed) describes someone with complete tooth loss or who has only hopeless teeth that required extraction.

The community periodontal index (CPI) of the WHO, which is commonly used to assess the periodontal status, was also used in this survey. With the help of a WHO periodontal probe, the depth of periodontal pockets was measured in millimeters at six points on both the buccal (facial) and lingual (palatal) sides of each of the six index teeth. The CPI divides the dentition into sextants for measurement and the severest score of the sextants was recorded during the oral-health examinations. The CPI provides a measurement, including 0 (healthy gingiva), 1 (occurrence of gingival bleeding), 2 (supragingival or

subgingival calculus), 3 (4—5-mm periodontal pockets), and 4 (periodontal pockets of >6 mm).

Independent variables

Patients were divided into four age groups: 20—44 years, 45—54 years, 55—64 years, and ≥65 years (65+). They were also categorized according to educational attainment: senior high school and above (senior+), junior high school (junior), elementary school (elementary), and no formal education. The marital status was divided into three categories: unmarried; married; and separated, divorced, or widowed (separated). The degree of disability, which included mild and moderate (moderate), severe, and profound, was in accordance with disability certificates issued by the Ministry of Interior, Taiwan. We divided the subjects into low-income and non-low-income groups according to their source of admission expense resources.

Antipsychotic medications used during the last 6 months before the oral examinations included first-generation antipsychotics such as Rosup, Haloperidol, Halin, Fluanxol, Clopixol, Mellazine, Sulpyride F. C., Surin, U-Dolan, Morefine, and Betamac; and non-FGA medications, such as second-generation antipsychotics (e.g., Mezapin, Uspen, Clopine, Zyprexa, Lodopin, Risperdal, and Seroquel), third-generation antipsychotics (e.g., Abilify), and mixed-type antipsychotic medication.

Data collection and analysis

Data collection began in January 2006 and was completed in December 2006. Oral-health indices were prepared and summarized. Subsequently, the data files were designed by MS Access and analyzed using SPSS software version 15.0 (SPSS, Chicago, IL, USA). The proportions, group means, and standard deviations were calculated. Chi-squared and analysis of variance tests were used to compare findings among subject gender and age groups. We used Bonferroni's adjustment to declare any significant difference between all possible pairs of groups maintained at a fixed significance level after the analysis of variance test. The Chi-squared test was used to detect trends in the proportions of CE, Ed, and CPI ≥ 3 in each succeeding column. Statistical significance was set to $P < 0.05$.

We then developed four multivariate regression models to adjust the estimated effects of risk factors on the oral-health indices to examine the effect of other potentially confounding factors. We used multiple linear regressions to summarize relationships among the DMFT, FI, NT, and a number of independent variables and estimated the beta value (β) and standard error for those independent variables, together with their significance (P) values. Whereas, a multiple logistic regression was performed to investigate the independent effect of significant variables on the risk of periodontal pockets of >4 mm after adjusting for other factors. The odds ratios of those independent variables compared with the reference category with their significance (P) and 95% confidence intervals were estimated. To measure the predicted probability of the logistic models, the area under the receiver-operating characteristic (ROC) curve was calculated. The area under the ROC curve can be used as a measure of the performance of the predicting model.

Results

Among the 1103 patients with schizophrenia evaluated, 55 (5.0%) were found to be edentulous. Thus, 1048 dentate subjects completed the CPI examinations. Table 1 shows the characteristics of subjects. Men comprises 73% of the population and the mean age of subjects was 50.8 ± 10.8 (range, 20—101) years. Subjects had been institutionalized in the hospital for an average of 8.4 ± 5.7 years.

Tables 2—4 show the distributions of the decayed tooth, MT, FT, DMFT, FI, NT, CE, Ed, and CPI ≥ 3 among subjects by gender and age group. The proportion of subjects with dental caries experience was 98.5%, the mean value of the DMFT index was 13.94%, the mean FI was 14.3%, and the mean NT was 17.66%. In both men and women, all indices, except for CE, were found to have significant differences across age.

Multivariate analysis results

Results of the multiple regressions are shown in Table 5. Only the association of age with DMFT, NT, and CPI ≥ 3

Table 1 Characteristics of subjects with schizophrenia who completed the oral-health survey in Yu-Li Hospital, Department of Health.

Variables	*n* (%)
Total	1103 (100.0)
Sex	
Men	805 (73.0)
Women	298 (27.0)
Age	
20—44	301 (27.3)
45—54	425 (38.5)
55—64	257 (23.3)
65+	120 (10.9)
Education	
Senior+	231 (20.9)
Junior	237 (21.5)
Elementary	516 (46.8)
No formal education	119 (10.8)
Marital status	
Unmarried	848 (76.9)
Married	115 (10.4)
Separated	140 (12.7)
Degree of disability	
Moderate	237 (21.5)
Severe	744 (67.5)
Profound	122 (11.1)
Economic status	
Non-low income	240 (21.8)
Low income	863 (78.2)
Antipsychotics	
FGA	411 (37.3)
Non-FGA	692 (62.7)

FGA = first-generation antipsychotics.

Table 2 Distribution of DT, MT, and FT among subjects with schizophrenia by sex and age group.

Age	Men			Women			Total		
	DT	MT	FT	DT	MT	FT	DT	MT	FT
	Mean (SD)	Mean (SD)	Mean (SD)	Mean (SD)	Mean (SD)	Mean (SD)	Mean (SD)	Mean (SD)	Mean (SD)
20−44 (Group 1)	1.80 (2.10)	6.04 (6.31)	2.13 (3.54)	1.99 (2.11)	5.17 (5.70)	4.42 (5.44)	1.85 (2.10)	5.80 (6.15)	2.76 (4.27)
45−54 (Group 2)	1.58 (1.90)	10.02 (8.30)	1.32 (3.46)	1.99 (1.88)	8.64 (7.14)	1.66 (3.29)	1.68 (1.90)	9.67 (8.04)	1.40 (3.42)
55−64 (Group 3)	1.88 (2.50)	13.58 (8.74)	1.31 (3.81)	1.49 (1.96)	13.69 (8.79)	1.68 (4.66)	1.76 (2.35)	13.61 (8.74)	1.42 (4.08)
65+ (Group4)	1.17 (1.70)	19.47 (8.33)	0.76 (3.46)	0.87 (1.38)	18.23 (8.22)	0.20 (0.61)	1.09 (1.63)	19.16 (8.29)	0.62 (3.01)
P of ANOVA test	0.037	<0.001	0.008	0.015	<0.001	<0.001	0.006	<0.001	<0.001
Post-Hoc test[a]	3 versus 4	All	1 versus 4	1 versus 4 2 versus 4	All	1 versus 2 1 versus 3 1 versus 4	1 versus 4 2 versus 4 3 versus 4	All	1 versus 2 1 versus 3 1 versus 4
Total	1.66 (2.09)	10.79 (8.89)	1.47 (3.58)	1.75 (1.95)	9.94 (8.44)	2.29 (4.43)	1.68 (2.05)	10.56 (8.78)	1.69 (3.84)

[a] Method of Bonferroni adjustment, showing pairs of significant difference.
ANOVA = analysis of variance; DT = decayed teeth; FT = filled teeth; MT = missing teeth; SD = standard deviation.

achieved statistical significance (all $P < 0.05$). Age was independently associated with the DMFT, NT, and CPI ≥ 3 after adjusting for other potential independent variables, including LOS in the hospital, gender, educational level, marital status, degree of disability, economic status, and use of antipsychotics.

Age was associated with the DMFT; i.e., elder subjects ($\beta = 0.41$, $P < 0.001$) were more likely to have higher DMFT scores. The R^2 value of the multiple regression equation for the DMFT was 0.16.

We observed that gender, age, educational level, and LOS were significantly associated with the FI. In other words, men ($\beta = -0.08$, $P = 0.011$), of an older age ($\beta = -0.22$, $P < 0.001$), with lower educational attainment (β values ranging -0.10 to -0.18, all $P < 0.05$), and a longer LOS ($\beta = -0.15$, $P < 0.001$) were more likely to have low FI scores. The R^2 value of the multiple regression equation for the FI was 0.15.

Age was shown to have a significant association with the NT. Those of older age ($\beta = -0.47$, $P < 0.001$) were more

Table 3 Distribution of DMFT index, FI, and NT among subjects with schizophrenia by sex and age group.

Age	Men			Women			Total		
	DMFT	FI (%)	NT	DMFT	FI (%)	NT	DMFT	FI (%)	NT
	Mean (SD)	Mean (SD)	Mean (SD)	Mean (SD)	Mean (SD)	Mean (SD)	Mean (SD)	Mean (SD)	Mean (SD)
20−44 (Group 1)	9.97 (7.18)	23.07 (31.7)	22.25 (6.28)	11.58 (6.95)	37.6(33.1)	23.08 (5.63)	10.41 (7.15)	27.1(32.7)	22.48 (6.11)
45−54 (Group 2)	12.92 (8.28)	10.8 (23.3)	18.24 (8.37)	12.29 (7.38)	14.2 (24.8)	19.52 (7.20)	12.76 (8.06)	11.7(23.7)	18.57 (8.10)
55−64 (Group 3)	16.76 (8.33)	8.9(20.8)	14.62 (8.78)	16.86 (7.88)	9.9(24.3)	14.49 (8.83)	16.79 (8.18)	9.2(21.9)	14.58 (8.78)
65+ (Group 4)	21.39 (7.78)	3.3(13.5)	8.69 (8.40)	19.30 (7.51)	1.8(6.0)	9.80 (8.24)	20.87 (7.74)	2.9(12.1)	8.97 (8.34)
P of ANOVA test	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
Post-Hoc test[a]	All	1 versus 2 1 versus 3 1 versus 4	All	1 versus 3 1 versus 4 2 versus 3 2 versus 4	1 versus 2 1 versus 3 1 versus 4	All	All	1 versus 2 1 versus 3 1 versus 4 2 versus 4	All
Total	13.93 (8.70)	12.8 (25.4)	17.45 (8.95)	13.98 (7.88)	18.3 (28.9)	18.23 (8.49)	13.94 (8.48)	14.3 (26.5)	17.66 (8.83)

[a] Method of Bonferroni adjustment, showing pairs of significant difference.
ANOVA = analysis of variance; DMFT = decayed, missing, and filled permanent teeth; FI = filling rate of DMFT index; NT = number of teeth; SD = standard deviation.

Table 4 Distribution of CE, Ed, and periodontal depth ≥4 mm (CPI ≥ 3) among subjects with schizophrenia by sex and age group.

Age	Men			Women			Total		
	CE	Ed	CPI ≥ 3	CE	Ed	CPI ≥ 3	CE	Ed	CPI ≥ 3
	n (%)	*n* (%)	*n* (%)	*n* (%)	*n* (%)	*n* (%)	*n* (%)	*n* (%)	*n* (%)
20–44	215 (98.6)	3 (1.4)	64 (29.8)	82 (98.8)	1 (1.2)	17 (20.7)	297 (98.7)	4 (1.3)	81 (27.3)
45–54	310 (97.8)	14 (4.4)	126 (41.6)	108 (100.0)	0 (0.0)	50 (46.3)	418 (98.4)	14 (3.3)	176 (42.8)
55–64	176 (97.8)	10 (5.6)	80 (47.1)	76 (98.7)	7 (9.1)	37 (52.9)	252 (98.1)	17 (6.6)	117 (48.8)
65+	90 (100.0)	17 (18.9)	29 (39.7)	30 (100.0)	3 (10.0)	10 (37.0)	120 (100.0)	20 (16.7)	39 (39.0)
P of Chi-square test	0.491	<0.001	0.004	0.628	0.002	<0.001	0.503	<0.001	<0.001
Trend test P	0.678	<0.001	0.006	0.787	0.001	0.003	0.627	<0.001	<0.001
Total	791 (98.3)	44 (5.5)	299 (39.3)	296 (99.3)	11 (3.7)	114 (39.7)	1087 (98.5)	55 (5.0)	413 (39.4)

CE = caries experience; CPI = community periodontal index; Ed = edentulism.

likely to have lower NTs. The R^2 value of the multiple regression equation for the NT was 0.26.

The association between CPI ≥ 3 and age was found to be statistically significant with an odds ratio of 1.02 (95% confidence interval 1.01–1.04, P = 0.001), and the area under the ROC curve of this multiple logistic regression equation for CPI ≥ 3 was 0.59.

Discussion

To investigate relationships between potential factors and oral-health indices, this study used data of a cross-sectional oral-health survey involving 1103 hospitalized inpatients with schizophrenia in eastern Taiwan. We found that the MT was the most important component of the DMFT. Age was the only significant explanatory variable that entered the final regression model for the DMFT, NT, and CPI ≥ 3. Gender, age, educational level, and LOS were significantly associated with the FI. These results describe the oral-health status of inpatients with schizophrenia and they have implications for the study of factors related to the oral health of this population with special needs.

Despite the focus on single psychiatric diagnosis, i.e., schizophrenia, and the inclusion of a relatively large sample size, the design of the present study was not without limitations. First, subjects came from only one hospital. Thus, the generalization of the results to other populations may be limited. Second, some potential confounders were not included in the analyses because of difficulties in collecting valid data.

Table 2 shows that the contributions of the MT to the DMFT were 77.5% in men and 71.1% in women, suggesting that dental extraction or prosthetic treatment is their most important dental-treatment need. Furthermore, Table 4 indicates that more than 40% of subjects who were ≥45 years old had periodontal pocket depths of ≥4 mm. This result reveals the great need for periodontal treatment. To evaluate the adequacy of manpower and other resources for dental care of this special population, it is necessary to study the dental-treatment needs of inpatients with schizophrenia.

Table 5 Multivariate analyses between the potential explanatory variables[a] and DMFT index, FI, NT, and periodontal depth ≥4 mm (CPI ≥ 3) among subjects with schizophrenia.

Variables	DMFT			FI (%)			NT			CPI ≥ 3		
	β	SE	P	β	SE	P	β	SE	P	OR	95% CI for OR	P
Age (y)	0.41	0.03	<0.001	−0.22	0.08	<0.001	−0.47	0.03	<0.001	1.02	1.01–1.04	0.001
Length of stay (y)				−0.15	0.15	<0.001						
Sex												
Men versus women				−0.08	1.80	0.011						
Education												
Junior versus senior+				−0.10	2.28	0.005						
Elementary versus senior+				−0.18	2.00	<0.001						
No formal education versus senior+				−0.13	2.91	<0.001						
Constant		1.35	0.098		4.28	<0.001		1.33	<0.001	0.17		<0.001
R^2		0.16			0.15			0.26			0.59[b]	

[a] Entered variables: age, length of stay, sex, education, marital status, degree of disability, antipsychotic, and economic status.
[b] Area under the ROC curve.
CI = confidence interval; CPI = community periodontal index; DMFT = decayed, missing, and filled permanent teeth; FI = filling rate of DMFT index; NT = number of teeth; OR = Odds ratio; ROC = receiver-operating characteristic; SE = standard error.

Tables 3 and 4 show that the average DMFT score, percentages of CPI $\geq$ 3, and Ed among subjects with schizophrenia were 13.9%, 39.4%, and 5%, respectively. The average DMFT score, percentages of CPI $\geq$ 3 and edentulous were 15.5%, 84.4% and 11%, in Italy with 297 psychiatric subjects at a mean age of 55 years;[22] whereas 24.9%, 33.5% and 32%, respectively, in Spain with 565 psychiatric subjects at a mean age of 58 years.[9,17] The situation with the oral health of this special population seems to be better in Taiwan compared with previous studies examining subjects with the same mean age.

We did not find the DMFT, NT, or CPI $\geq$ 3 to be related to any other independent variables examined in this study. Results indicated that high levels of oral-health indices among inpatients with schizophrenia were related to a predisposing factor, i.e., age, but not to other acquired factors. Subjects with schizophrenia may either be unable to perform oral-hygiene procedures by themselves or they may lack adequate dental care. The findings also consequently support an emphasis on inpatients with schizophrenia as a vulnerable group in terms of oral health.

In the equation for the DMFT index, the adjusted R^2 value was 0.16, indicating that 16% of the variance in the DMFT index could be predicted by age. The adjustment was affected by the magnitude of the effect. Many independent variables were used in this study; hence, there were difficulties with colinearity. A reduction in the number of independent variables might have helped to find a model that explains more about the variance in the dependent variables.

We found that factors associated with the FI were less-modifiable factors, such as gender and age, and also modifiable factors, such as lower educational attainment and a longer LOS in long-term care institutions. A partial explanation for this may lie in the fact that women tend to develop schizophrenia about 5 years later on average and have better outcomes than men.[7,18,19] The results suggest that this institution has not provided proper dental care to its residents.[20–22]

Conclusions

The results of our analyses show the overall oral-health and high dental-treatment needs of subjects with schizophrenia. Oral-health professionals should pay greater attention to the prevention of the occurrence of dental caries and periodontal diseases and long-term care institutions that take care of inpatients with schizophrenia should exert greater efforts in providing dental care for this special population.

References

1. Yaltirik M, Kocaelli H, Yargic I, Yaltirik M, Kocaelli H, Yargic I. Schizophrenia and dental management: review of the literature. *Quintessence Int* 2004;35(4):317–20.
2. Royal Australian and New Zealand College of Psychiatrists clinical practice guidelines for the treatment of schizophrenia and related disorders. *Aust N Z J Psychiatry* 2005;39(1–2): 1–30.
3. Chien IC, Chou YJ, Lin CH, et al. Prevalence and incidence of schizophrenia among national health insurance enrollees in Taiwan, 1996–2001. *Psychiatry Clin Neurosci* 2004;58(6): 611–8.
4. Dickerson FB, McNary SW, Brown CH, et al. Somatic healthcare utilization among adults with serious mental illness who are receiving community psychiatric services. *Med Care* 2003; 41(4):560–70.
5. McCreadie RG, Stevens H, Henderson J, et al. The dental health of people with schizophrenia. *Acta Psychiatr Scand* 2004;110(4):306–10.
6. Leucht S, Burkard T, Henderson J, Maj M, Sartorius N. Physical illness and schizophrenia: a review of the literature. *Acta Psychiatrica Scandinavica* 2007;116(5):317–33.
7. Friedlander AH, Marder SR. The psychopathology, medical management and dental implications of schizophrenia. *J Am Dent Assoc* 2002;133(5):603–10.
8. Kilbourne AM, Horvitz-Lennon M, Edward P, et al. Oral health in veterans affairs patients diagnosed with serious mental illness. *J Public Health Dent* 2007;67(1):42–8.
9. Velasco E, Machuca G, Martinez-Sahuquillo A, Rios V, Lacalle J, BulloAn P. Dental health among institutionalized psychiatric patients in Spain. *Special Care Dent* 1997;17(6):203–6.
10. Ogaard B, Koxvig IJ. Cariological conditions in patients in a psychiatric hospital in Norway. *Nor Tannlaegeforen Tid* 1991; 101(5):144–7.
11. Hede B. Oral health in Danish hospitalized psychiatric patients. *Community Dent Oral Epidemiol* 1995;23(1):44–8.
12. Locker D. Dental status, xerostomia and the oral health-related quality of life of an elderly institutionalized population. *Special Care Dent* 2003;23(3):86–93.
13. Lewis S, Jagger RG, Treasure E. The oral health of psychiatric in-patients in South Wales. *Special Care Dent* 2001;21(5): 182–6.
14. Rekha R, Hiremath SS, Bharath S. Oral health status and treatment requirements of hospitalized psychiatric patients in Bangalore city: a comparative study. *J Indian Soc Pedod Prev Dent* 2002;20(2):63–7.
15. Ramon T, Grinshpoon A, Zusman SP, Weizman A. Oral health and treatment needs of institutionalized chronic psychiatric patients in Israel. *Euro Psychiatry J Assoc Euro Psychiatr* 2003; 18(3):101–5.
16. WHO. *Oral Health Survey: basic Methods*, 4th ed. Geneva: World Health Organization, 1997.
17. Angelillo IF, Nobile CGA, Pavia M, Fazio P, Puca M, Amati A. Dental health and treatment needs in institutionalized psychiatric patients in Italy. *Community Dent Oral Epidemiol* 1995;23(6):360–4.
18. Leung A, Chue P. Sex differences in schizophrenia, a review of the literature. *Acta Psychiatrica Scandinavica* 2000;101(401): 3–38.
19. Ouyang W-C, Wang Y-C, Hong C-J, Tsai S-J. Estrogen receptor [alpha] gene polymorphism in schizophrenia: frequency, age at onset, symptomatology and prognosis. *Psychiatr Genet* 2001; 11(2):95–8.
20. Barnes GP, Allen EH, Parker WA, Lyon TC, Armentrout W, Cole JS. Dental treatment needs among hospitalized adult mental patients. *Special Care Dent* 1988;8(4):173–7.
21. Thomas A, Lavrentzou E, Karouzos C, Kontis C. Factors which influence the oral condition of chronic schizophrenia patients. *Special Care Dent* 1996;16(2):84–6.
22. Sjögren R, Nordström G. Oral health status of psychiatric patients. *J Clin Nurs* 2000;9(4):632–8.